

CISILENT[®]-GRP



< dB

Noise Control near High Speed Railway Lines

Not a Chance for Noise

Introduction

Modern high speed railway lines require new high-tech noise barriers. Conventional systems proved a failure due to lacking flexibility, constructive defects, failure of connecting means and resonance occurrences.

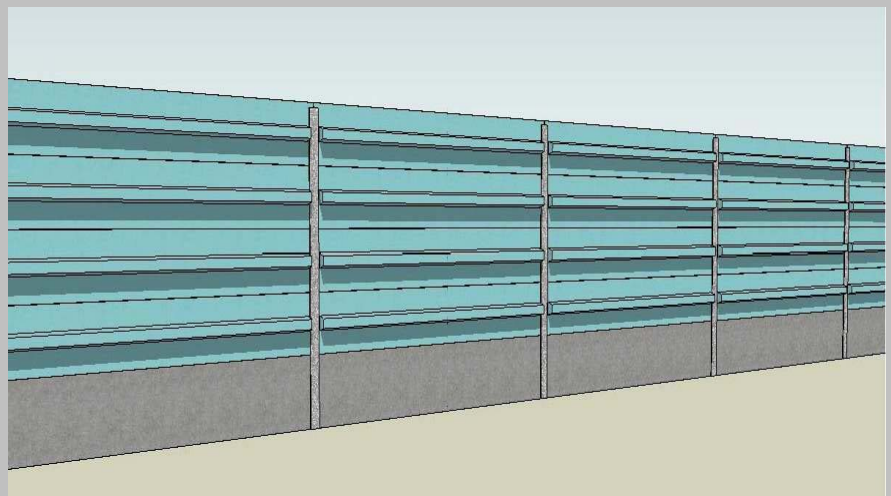
With a running speed of 300 km/h a wall is loaded with a dynamic pressure fluctuation which corresponds to a strong hurricane.

A sound barrier near high speed lines does not only need to provide a high insulating effect to protect the residents. The travelling comfort of the train passengers also requires a sound absorption as high as possible in all frequency ranges.

With the development of the lightweight and flexible noise control system Cisilent[®]-GRP Calenberg Ingenieure succeeded in meeting all these requirements.



Picture 1: Cisilent[®] - Sound Barrier, track side view



Picture 2: Cisilent[®] - Sound Barrier, view from outside the track

Design of the Sound Barrier

The Cisilent-GRP Element

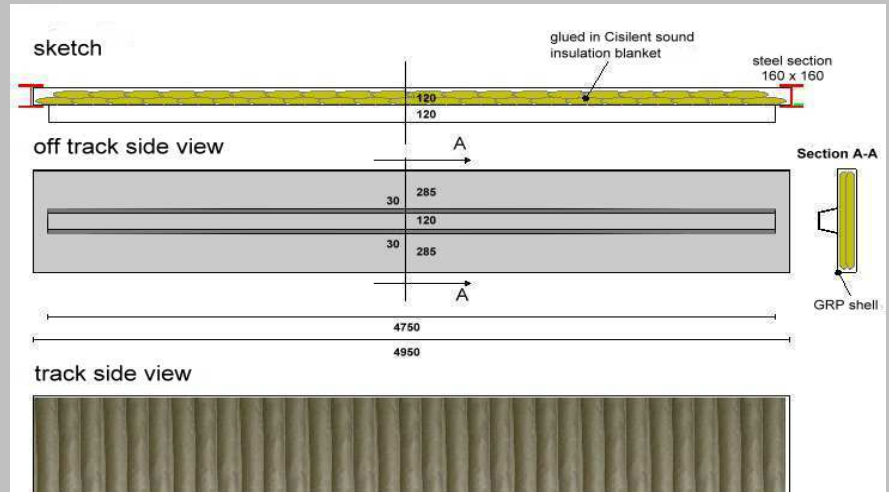
The Cisilent-GRP element consists of a GRP shell and a fitting sound insulation blanket which is glued into the shell (picture 3).

Sound Barrier made of Cisilent-GRP Sound-proofing Elements

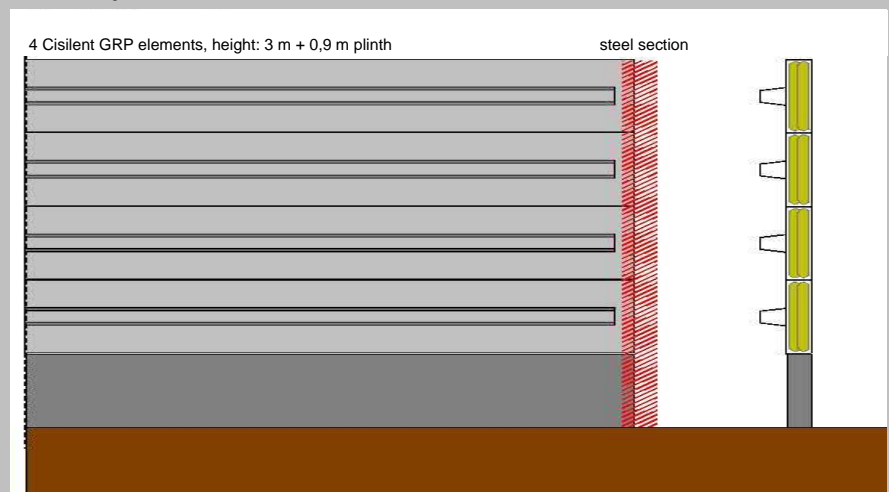
A sound barrier in principle consists of a concrete plinth and sound-proofing elements put on it. These components are put into upright steel girders. The steel girders are fixed to the concrete base (picture 4).

Conventional sound-proofing elements usually are made from aluminium or concrete. Those kinds of elements can easily be replaced by Cisilent-GRP sound-proofing elements.

In a next step the plinth can be replaced as well, e. g. by Cisilent-GRP sound-proofing elements or an alternative simpler GRP construction, e. g. a sand filled cuboid or similar. For the plinth area absorption is not required but only the standard sound insulation.



Picture 3: Single Cisilent element; view from both sides and cross sections



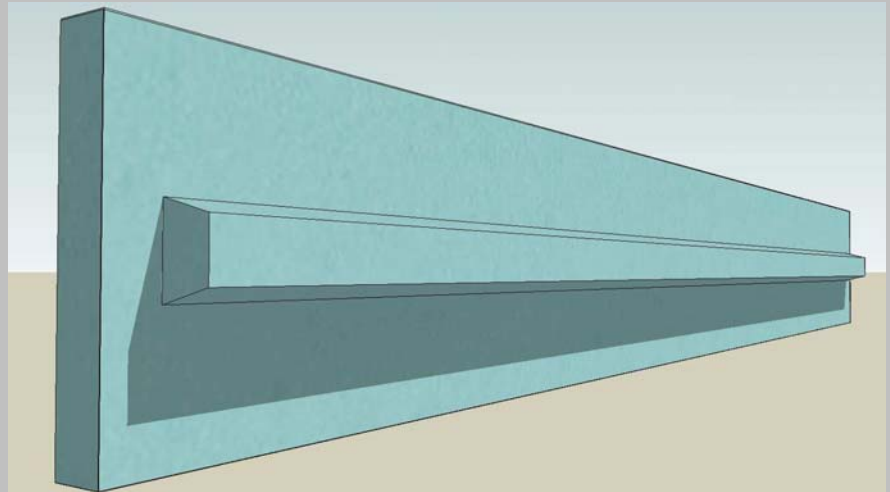
Picture 4: Sound Barrier made of Cisilent-GRP Elements; View from outside the track and cross section

Design of the GRP Shell

The Shell Composition

Shell material	Glas fibre reinforced plastic (GRP)
Thickness	e. g. 5-8 mm
Width of ribbing	120-240 mm
Height	500 und 750 mm
Length	Variable, max. 5 m

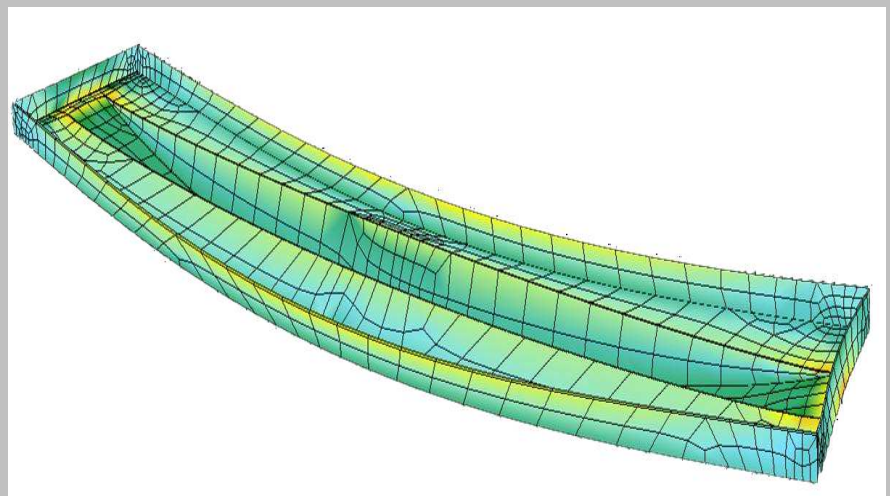
Connection between the shells themselves and with the concrete surface by means of Velcro strip (picture 5)



Picture 5: Cisilent –GRP Element

Deformation by Wind Pressure

The maximal horizontal deflection of the element due to wind influence at a train speed of 300 km/h is less than $L/300$ (picture 6)



Picture 6: FEM-Analysis; Deflection caused by Wind Load

Test Results on Absorption and Sound Insulating Value

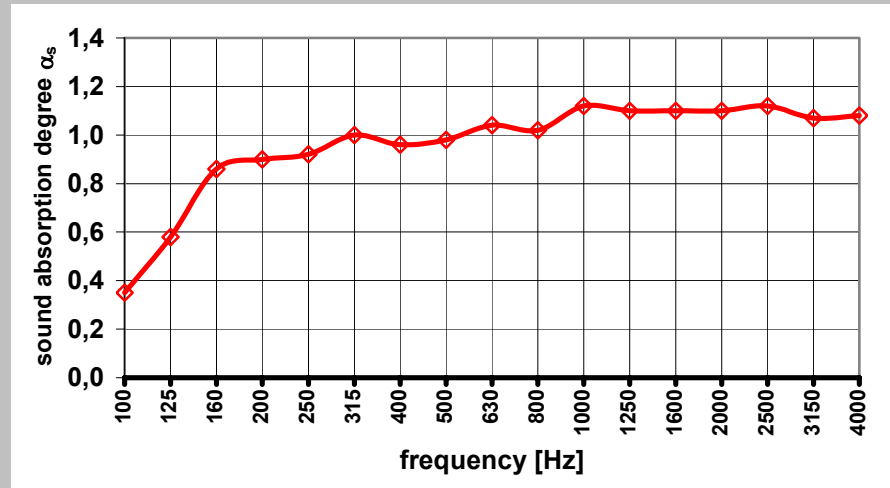
Sound Absorption (picture 7)

Evaluation according to the German ZTV-LSW 88 guideline

From the evaluation of the acoustic absorption behaviour according to the ZTV-Lsw 88 guideline arises:

$$\Delta L_{A,\alpha,Str} \geq 10 \text{ dB.}$$

Thus the textile Cisilent noise barrier by Calenberg Ingenieure has to be classified as high absorptive according to the guideline.



Picture 7: Sound absorption Value

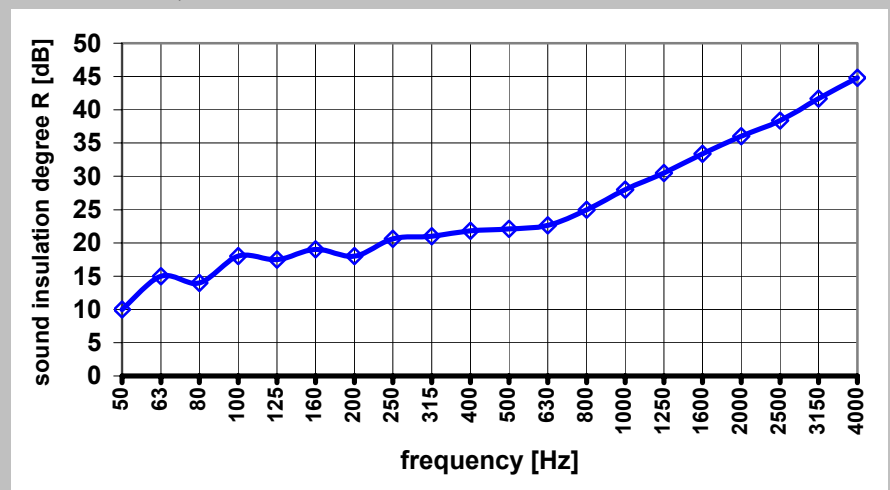
Sound Insulation (picture 8)

Evaluation according to the German ZTV-LSW 88 guideline

The calculation according to formula (1), paragraph 7.2.1 of the guideline results in the following value:

$$\Delta L_{A,\alpha,Str} = 25 \text{ dB.}$$

Thus the textile Cisilent noise barrier by Calenberg Ingenieure meets the requirement of paragraph 7.2.1 of the ZTV-Lsw 88 guideline.



Picture 8: Sound insulating Value

Judgement of the Absorption and Sound Insulation by German Railways DB

Absorption

The sound absorption required is achieved in all frequency ranges. Hence the textile noise barrier type "Cisilent" shows excellent absorbability.

Sound Insulation

The sound insulation within the medial frequency range of 500 Hz to 1000 Hz stays by approx. 2 dB below the required limit values.

Within the frequency range below 500 Hz and above 1000 Hz the sound insulation required is met.

Based upon the spectrum of the rail traffic a total sound insulating value of 26 dB(A) was determined. As a result the element can be used when according to the "Schall 03" ("Sound 03") - a German guideline for calculating the sound immission caused by railways /2/ - a shielding effect of up to 15 dB(A) is determined.

Release by DB

Referred to its acoustic properties the textile noise barrier type "Cisilent" can be released for the use within the Deutsche Bahn AG railway network.

„Acoustic Approval“ granted by DB (picture 9)

Die Bahn 

Deutsche Bahn AG
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Technik/Beschaffung
Akustik und Erschütterungen
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Untersuchungsbericht
Akustische Überprüfung
Calenberg Folienschallschutzwand
Typ „Cisilent“

messe  **prüfen**

Dokument: 04-8003566-T.TZF 12
Datum: 01.06.2005

Durchführung: Deutsche Bahn AG
Technik/Beschaffung
DB Systemtechnik
Akustik und Erschütterungen - T.TZF 12
Völckerstr. 5
80939 München

Picture 9: Approval by Deutsche Bahn AG

Advantages of the Cisilent-GRP Elements

Load-bearing Capacity

- Cisilent-GRP elements are non-rigid regarding torsion and rigid regarding bending
- Very low dynamic magnification factor due to high natural frequency
- Cisilent-GRP elements are stiff in vertical direction, the load of the upper elements can without any problem be carried by the elements below.

Constructive

- Lightweight: weight per unit area approx. 24 kg/m²:
Weight of element approx. 90 kg
- Very high frequency spacing related to exciting frequency
= low dynamic factor
- Low stress
= long service life
- Freezing and thawing cycle does neither harm the shell nor the insulating layer (in opposite to a concrete shell)
- No corrosion
- No connecting means
- No components conducting current
- No grounding

Sound-proofing Membrane:

- Membrane proven for many years, 10 years guarantee available
- Filling of mineral fiber is supported by the Cisilent membrane
+ flakes are glued with each other
= no dissociation possible
- Cisilent membrane with filling is flexible and follows the movements of the shell

Sound-proofing: Effectiveness

- No rejects due to faulty acoustic effectiveness
= no expensive individual tests necessary
- No „crash“ of the acoustic properties with certain frequencies

Installation

- Transport to site possible with lightweight vehicles and thus easier access
- Due to the relative low weight of approx. 120 kg very easy installation or removal:
- 3 – 4 workmen can move the elements by hand
- Only small lifting device required
- Due to small part sizes no conflicts with catenary or similar

Costs

- The costs of the shell decrease with bigger number of pieces (the moulds are made better use of)
- As a result the elements become cheaper, too and can be on offer more attractively if the batch quantity is bigger

Safety against Vandalism, Repair, Maintenance

- No maintenance required
- The GRP shell is very robust against vandalism:
Cannot be seriously damaged with standard tools
- In case of damage to the GRP shell as part of the element facing the surroundings of the track, it can easily be repaired by laminating a GRP layer on top of the defect (standard technique for GRP repairs)
- The textile membrane as track side part of the element can be repaired with patches
- Only the surface of the shell can be scratched (coloured plastic)
- Easy removal of graffiti due to smooth surface

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